



China: Classification, Characteristics, and Development Status of m-Health Management Apps

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Abstract. In recent years, China's economic level is constantly improving, however, the health risks of residents are increasing year by year. This is partly due to the wave of aging, but also linked to a variety of unhealthy lifestyle habits. China's Internet industry is keenly aware of residents' health needs and has quickly launched a series of health management services. This paper summarizes the classification, characteristics, advantages and disadvantages of current mobile health management applications in China, and discusses their development prospects. The conclusion is that all kinds of mobile health management services in China, as an emerging thing in the rising stage of development, have a profound impact on the daily diet, sports, medical treatment and other ways of the Chinese public, but there are certain deficiencies in functions, safety, user stickiness and other aspects.

Keywords: Mobile health management applications · Medical and m-Health management · Health care

1 Introduction

Health management is a process for the comprehensive management of health risk factors in an individual or population. Health management emerged from the United States in the 1980s and gradually settled in China at the beginning of the 21st century. Its development is closely related to changes in the social environment, economic and cultural development [1]. In recent years, China's economic development has been growing steadily, however, the unreasonable diet and lifestyle significantly negatively impact people's health. Many residents suffer from chronic diseases such as hyperglycemia and hypertension, and a certain proportion of the population is in a sub-health state all year round [2]. A data survey in 2019 showed that there are 510 million Chinese people with overweight or obesity, 420 million people with hypertension, 120 million people with diabetics, and even 10,000 people diagnosed with cancer every day. It indicates the situation of Chinese people face severe challenges. China established the world's largest essential old-age medical services in a short period to meet the challenge.

Nonetheless, the number of people with chronic diseases and in the sub-health state continues to grow, and the aging population accelerated, putting much pressure on medical resources in China. Health insurance fund already incurs a financial deficit in some regions, and the health insurance system is suffering a sustainability challenge. So China publishes a series of policies to promote the development of the health services industry and to encourage residents to strengthen their awareness of health management. It is expected to help residents control unreasonable and related factors that endanger their health to improve residents' health, which could alleviate the pressure on medical resources and strengthen public health construction.

Fortunately, a series of technologies, such as the Internet of Things (IoT), sensors, artificial intelligence, and data transmission, allows the integration of health management and intelligent technology, giving birth to mobile health management applications [3]. The definition of m-Health management apps is to use mobile communication devices such as notebook computers, portable computers, wireless phones, tablet computers, smartphones, Etc. to meet consumers' needs for health care or health information services.

The purpose of this article is to determine the classification, characteristics, and development status of m-Health management applications in China, including four parts: (1) The health status and needs of Chinese residents; (2) The classification and characteristics of m-Health management APPs in China; (3) Medical and m-Health management; (4) The challenges and deficiencies of the development of m-Health management.

2 The Health Status and Needs of Chinese Residents

The health status of residents refers to a well-off state of life in all aspects of physical, psychological, and social adaptation. China's public health system keeps improving, and so does the health status of residents. Chinese residents' life expectancy has increased from 76.5 in 2016 to 77.3 in 2020. Although it is a significant improvement, the increase in lifetime is just a macroscopic phenomenon because the length of time of adverse life states is also lengthening. There is still an increase in the number of patients with chronic diseases in China as the population ages, industrialization advances, and behavioral risk factors are prevalent. The chronic disease incidence among residents increased from 245.2‰ to 342.9‰ from 2013 to 2018, according to a survey by Chinese health services. In 2019, deaths due to chronic diseases accounted for 88.5% of total deaths in China. Facing the increasing population of chronic diseases, many people have emphasized the need for improvement and strengthening of medical care. Improving medical treatment leads to better disease outcomes, but it is not the root of the solution to chronic diseases.

Sub-health is a state between health and disease. Most of them in a sub-health state will show symptoms of reduced vitality, physical function, and social adaptability for a certain period [4]. However, they do not meet modern medicine-related diseases' clinical or sub-clinical diagnostic standards. Approximately two-thirds of Chinese live in sub-health, 18% suffer from illness, and just 15% live in good health. Actually, unhealthy lifestyle is a crucial reason for sub-health. A healthy person will gradually change to sub-health if he always in a bad lifestyle with unreasonable diet, lack of exercise, irregular work and rest, lack of sleep, mental tension, psychological stress, and poor emotions.

Sub-health will worsen and eventually become a chronic disease if these factors are not improved and alleviated. The above negative factors are already common in the daily lives of Chinese residents, which is a potential health hazard. Fortunately, as residents grow in health awareness, many have become aware of their potential health issues. They actively seek help to reduce these health threats through regulation and guidance. The emergence of mobile health management is an opportunity point with the upgrading of personalized smartphones and the development of Internet technology. Many people believe that m-Health management Apps will be a promising direction.

3 Classification and Characteristics of M-Health Management APPs in China

Before the emergence of AI, health management spends a long time acquiring health information. It resulted in the inability to form a health trend line and to conduct timely and effective evaluations, which often influenced the early identification of diseases. Thanks to the rapid development of the AI big data industry, m-Health management has completed indicator tracking, risk assessment, and health evaluation of health status through diet and nutrition management, body health monitoring, early screening for disease protection, lifestyle intervention, rehabilitation management, Etc [5]. For more effective intervention improvement and early protection. Improving unhealthy lifestyles to decrease disease incidences and increase rehabilitation success rates among those with diseases are its core goals. As a dynamic health service model, m-Health management has received national attention and support, being recognized and accepted by mainstream society. Numerous positive factors prompt participants to jointly develop the related APPs, which gradually evolve into APPs targeted at healthy diet, weight loss, fitness, mother-to-child care, Etc.

3.1 Healthy Diet

The infrastructure of the apps is the food material database, dietary health database, and the mapping relationship between diseases, symptoms, and food. Its primary function is to provide various dietary management solutions for people with different health conditions. Most healthy eating apps try to obtain personal daily diet status and nutritional data, so their functions also include the following: (1) diet record report, (2) nutrition and health status assessment, (3) nutrient structure analysis, (4) consultation and guidance from nutrition experts. Although these apps hope to provide users with self-observation and behavioral measurement, it is not easy to play a supervisory role because the implementation of the solution is not guaranteed, and there needs a suitable equipment to monitor the daily dietary status of individuals.

3.2 Weight Loss

This is the most popular category of apps because it is the spiritual sustenance of many obese people. There are many causes of obesity. Its essence is a metabolic syndrome related to diet, nutrition, sleep, body hormones, and others. As far as the current research

results are concerned, some effective intervention strategies exist. The apps combine diet, activity, and lifestyle behaviors with weight management to control daily calories. The services provided include (1) a structured diet plan or diet method, (2) meal replacement service, (3) exercise class, (4) food calorie calculation, (5) real-time monitoring of body indicators, data recording, and analysis, (6) remote guidance and supervision. Most apps are bound to intelligent devices such as body fat scales and smart bracelets. The real-time data is automatically uploaded to the cloud, allowing the application to adjust meal plans on time. A considerable proportion of the population has benefited from weight loss management applications and successfully lost weight, but more users ultimately failed to lose weight because most of them lack executive power and self-control.

3.3 Sports and Fitness

This type of application mode is relatively diversified, but most of them dedicated to providing (1) fitness video courses, (2) check-in of running, cycling, and other sports, (3) professional diet guidance, (4) sports and intelligent sports equipment purchase. Interestingly, compared with other health management applications, users mostly activate sports applications before bed at night. The reason is that they are busy with work during the day, and most users only have relatively free and free time at night, which leads to their habit of exercising before bed. However, due to the emergence of a large number of sports software in the market in a short period, many applications are not professional enough, resulting in insufficient user stickiness and a high turnover rate. Even so, the sports and fitness category still has the highest number of users among all health management applications.

4 Medical and m-Health Management

m-Health management in the medical industry is mostly called digital medical service APPs. Its service aims to provide residents with timely medical assistance without relying entirely on hospitals. It helps residents through online consultation, disease inquiry, and drug purchases. When residents occasionally feel minor illnesses and discomforts, most do not want to spend their time and energy going to the hospital for a diagnosis in their fast pace of life. They want simple advice, guidance, and medications to relieve their discomfort. To achieve the above services, most of these apps are authoritative. Apps collaborate with doctors, researchers, hospitals, biopharmaceutical companies, and insurance companies to provide professional and authoritative scientific content and medical guidance [6]. Besides, these apps are rich and comprehensive in medical data accumulation to support intelligent consultation services. After the consultation, APPs can also provide the recommendation, ordering, and distribution services of medicine.

Even so, the management functions of APPs need to be more comprehensive. Dynamic monitoring of physical data is essential in cases where abnormal physical indicators do not necessarily cause discomfort but may indicate the risk of illness in the future, which is extremely common in the elderly. Fortunately, the APPs of wearable sensor technology have effectively made up for it. Health data such as heart rate, blood pressure, and blood sugar are monitored through wearable electronic devices such as

muscle oxygen detectors and heart rate armbands [7]. The data can be transmitted to the background management center of the software in real-time through a Bluetooth connection. The abnormal indicators will timely warn once the data has been calculated and analyzed. In fact, most digital health apps in China integrate with intelligent hardware and software systems. The application consists of five parts, i. e. wearable device end, store end, doctor end, medical institution end, and service end.

(1) Wearable device terminal

Generally composed of components such as batteries, communication equipment, microcontrollers, and sensors, it is one of the sources of body index data. It is necessary to ensure the data's authenticity, integrity, and reliability.

(2) Store

It is a service port corresponding to pharmacies, wearable device product providers, and special medical resource providers. It is mainly convenient for users to purchase pharmaceutical products and provide timely remote logistics and distribution.

(3) Doctor

The client terminal is used by doctors remotely. Its primary responsibilities include communicating in audio and video according to consultation needs, analyzing online diagnosis and treatment, issuing prescriptions, Etc.

(4) Medical institutions

Offline clinics, health management centers, or hospitals provide users with various medical services such as appointment registration, report inquiry, hospitalization services, and payment of medical services. Some institutions can even provide timely solution guidance for the abnormal indicator data provided by wearable devices.

(5) Server

The primary function is to provide various service resources to meet the complex needs of individuals for health and provides functions, such as service scheduling queues. The apps include physical examination, traditional Chinese medicine physiotherapy, home care, genetic testing, rehabilitation companions, Etc. It will support doctors and medical on the institutional side, which improves the management and maintenance of personal health [8].

Currently, in China, medical m-Health apps are more authoritative and effective than others because users are more compliant. To verify the improvement effect of medical applications on health management, Nanjing Drum Tower Hospital conducted verification and observation on 80 overweight and obese patients. They used medical apps as the experimental group based on weight management in the obesity clinic of the hospital. After 12 weeks, the body weight of the experimental group decreased (9.2 ± 3.9) %, higher than the control group (6.0 ± 5.0) % ($P < 0.01$). In addition, the improvements of the experimental group, such as BMI, body fat, body fat percentage, trunk fat, visceral fat area, glycosylated hemoglobin, high density lipoprotein cholesterol and protein energy supply ratio, were also better. Although the experiment time is short, it still shows that health and medical applications are beneficial to play a role as a reminder to correct users' unhealthy lifestyles and improve their health to some extent.

5 The Challenges and Deficiencies of the Development of m-Health Management

Now, China's m-Health management has many apps and shows a rapid increase in research. However, just 12% of the more than 8,000 health-related applications are downloaded. Moreover, users' actual usage rate and continuous use willingness are not satisfactory, so the health promotion effect of related apps cannot be reflected. There are some challenges and deficiencies that deserve attention.

- (1) Research on mobile health management apps currently focused on functions, technology, and security, without a bottleneck breakthrough in user stickiness, which is an important indicator to evaluate the user behavior and market value of Internet products. There are two possible reasons for the low user stickiness. On the one hand, the perceived usability and ease of use of these apps could be stronger, which may be related to the logic of interface interaction of the apps, management scheme, and actual implementation effects [10]. On the other hand, maintaining and managing physical health requires individuals to have higher self-supervision and self-discipline in implementation programs. Besides, most people cannot overcome their laziness, and resist the temptation of alcohol, nicotine, or high-calorie foods.
- (2) The accuracy and professionalism of health management programs are essential. However, there is a lack of professional participation in the R&D and construction of some apps, making users question these apps' accuracy and authority [9].
- (3) Overly fragmented content is also a significant issue at present. Many applications focus on a specific area, such as food management. However, they cannot provide a corresponding food management solution for people with a whole life cycle. The program base behind it needs to be richer and be flexible to change, which requires a sufficient development of intelligent algorithms.

6 Conclusion

With the development of mobile Internet technology, the traditional health management service model has dramatically changed. The m-Health management apps, emerging in the rising stage of development, have intervened in various ways to improve residents' health. It has profoundly impacted Chinese residents' daily diet, exercise, and medical treatment. However, the essence of such applications is to provide users with health services, and they are currently facing a high rate of user loss. The key points that need further improvement are strengthening authority and professionalism, increasing user stickiness, and ensuring high loyalty and utilization rate.

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